CINR Workscope Specific Q&A

NEUP Overview

What are the success rates of the IRP program?

The IRP, of course, has been very popular because of the large dollar values and more directed scope. I think on the average it's between 15 and 20 percent but it's highly depended on the individual workscopes for the IRPs. Some IRPs, we've had as many as 12 to 15 submissions with 1 winner, then with other workscopes of IRPs, we've had 4 or 5 submissions and 1 winner, so we encourage you to submit to the IRPs. We know it's a big commitment and it's a lot of work because you are bringing in additional collaborators from other universities, industry, etc., but it's some of our most important work.

Being such large projects, why don't IRPs have the pre-application review process?

It's schedule-driven in two different ways – putting together a large proposal for a pre-application and then turning it around very quickly is just impractical because of the amount of time and effort it takes for the larger IRP. We've never had a problem with the current IRP submission scheduling in the sense that we give the IRPs much more time to accomplish that and we've gotten very good proposals and a good submission rate.

Please do remember that we're spending this year's fiscal dollar this year, which means we have contextual confinement on the other end of our process, from the amount of time we give you to respond to the FOA, put together a competent team and write your application to the time it takes to find and execute a review panel, and then the time that it takes to actually do the procurement actions. So with the confines of the year, given the size of the programs that's the timeframe that we have. If we were to implement something like a pre-application, that time would all have to come from some place, and currently it's just not feasible.

I'm confused about the submission limits. It's unclear to me if the maximum number of awards is three (3) or if the maximum number of pre-applications we can submit is three. Can you clarify?

The maximum number of pre-applications that you can submit is six. Of those six, you may be the PI on three. If you submit three pre-applications as the lead PI, and currently have no funded R&D, you are eligible to compete all three of those. You are only eligible to have three R&D projects at any one time, which means if you were invited on three of your pre-applications as a principal, but had two existing projects that will be active beyond December 31, 2017, you would have to choose which single application you would compete.

That's all driven out in the workflow. We answer all of those questions specifically and if you're still confused, you can call any of us after the webinar and we can talk you through it. The workflow is on one of the last slides I presented—there is a link there.

On slide 17, it states that applicants cannot have more than three (3) R&D projects. Is it correct to assume you mean three DOE NE projects?

That is correct. Three DOE NE-sponsored projects.

If a project is awarded and a PI changes his/her institution, can the project be transferred to the PI's new institution?

There is a way for that to happen, but it depends on the individual circumstance. It's a case-by-case review, so I can't say "yes" or "no" to that. There is a process, but it just depends.

The reason for this is because the project is awarded to a university and if you transfer to another university, technically, that university did not compete for that award. Therefore, it would have to be awarded non-competitively, and that takes some time and effort to work out.

Let's add that, if a faculty member transfers to another university, which happens all of the time, a sub-award can be put in place from the original university to conduct the research, so that's possible as well. The capability to conduct the research wherever the money flows has to be there, so it's judged on a case-by-case basis. In general, we're trying to get the money to where the work is done and where they have the capability of doing it.

If DOE does reject a transfer, what would happen to the project?

If it's rejected, then the project would no longer be available for award. If the university put up an alternate PI and said they could do the work and that PI was approved, they could go on with that. It doesn't necessarily have to be PI-centric, but they would have to replace that person with someone with the same capabilities.

On slides 27 and 28, it states that CVs are required for institutional leads. Is it permissible to provide CVs for collaborators as well?

Absolutely, and you would provide those in the Benefit of Collaborations and we have specific guidance for you on the website with how many pages those CVs can have and how many people should be providing CVs.

Which workscopes are required to submit LOIs?

If you respond to Appendices A or B and you have an NSUF tie, you are required to submit an LOI. LOIs are not defined by workscope; they're defined by having an application that involves an NSUF facility.

NSUF workscopes can be found in Appendix B. NSUF-1, all of those workscopes, require an LOI, as do applications submitted to NSUF-2 Access Only. One workscope in Appendix A, NEAMS-2, will require an LOI as well.

Who can act as a PI?

We have no restrictions on who cannot act as a PI. PIs can be anyone that a university allows to be a PI. That is a local decision. Typically it's a tenured or tenured-track faculty member. Could be a post-doc. If it's allowed locally by a particular university, and they're the legitimate originator of the materials submitted as the proposal, it could be a research staff member, a Ph.D. typically, that's permitted by the individual university to conduct that kind of research. We have a number of PIs who fall into all of those categories, either as advanced post-docs, research staff members, tenure track and tenured faculty. It largely depends upon the judgments of the originating university.

In the draft workscope that was released last week, the Integral Benchmark Evaluations, MS-NE-1, workscope, was listed with a TBD. When do you expect that workscope to be available?

We don't have a definitive timeframe for that. We're hoping within the next week all of those decisions will be made. We're still crafting some workscopes. As was announced this morning, we just learned that the U.K. will be participating with us in select workscopes, so as we have that, it will be made available. Unfortunately, we do not have an exact date.

I believe international collaborators can be added after the pre-application process. Can U.S. collaborators also be added to the proposal after the pre-application process?

Yes, collaborators can be added after the pre-application process, but you do need to interface with the Integration Office. Please remember that we assign reviewers based on the institutional conflict of interest. We've got to affirm that we haven't either used that individual, or their presence doesn't disrupt the field. So while you can them, you do need permission to do so. That ultimate permission is given by the Contracting Officer for the solicitation.

If I propose as a PI on an IRP, can I also be a co-PI on an NEUP application?

Yes, you may.

If I am a PI on a currently funded IRP, can I be a co-PI on an NEUP application?

Yes, you can. You cannot, however, be a lead PI. All of our eligibility restrictions are attributed to the lead PI and, to that end, if you do not execute, it is the lead PI who is held responsible.

It is unclear where we can access all of these documents, whether it's through the NEUP site, DOE-NE or Office of Science. Can you clarify where we can find supporting information?

The formal copy of the FOA is hosted on www.grants.gov. A copy of professional courtesy of the FOA is at www.neup.gov. All of the other resources can be found through www.neup.gov and your application will be submitted through www.neup.gov.

Is international collaboration permitted? Could we budget for an international entity?

International collaboration is permitted, but you may send no money to an international collaborator so, therefore, you may not budget for an international collaborator. Funds can only be sent to domestic entities.

NSUF Overview

Can you please repeat the eligibility requirements for NSUF Access grants, both in the NSUF-1 and NSUF-2 categories?

The NSUF-2 Access Only do not have any eligibility requirements associated with them, meaning if you are a university, national laboratory, or industry collaborator, you can submit a NSUF-2 Access Only application regardless of what you currently have.

The eligibility restrictions for the NSUF-1 workscope and NEAMS-2 workscope, which are both NSUF related, are that university PIs can submit up to six (6) applications, but no more than three (3) as the lead PI. If you have a currently funded IRP, or more than three currently funded R&D awards, you are not eligible to apply. The other eligibility restriction is that, if you have an existing no-cost time extension that will go past December 31, 2017, you are also not allowed to apply in the NSUF-1 category.

An important distinction here is that all NSUF applications are on a case-by-case on the eligibility requirements outlined in the CINR FOA, so please refer to those eligibility requirements. If you do have any questions, contact the INR Integration staff contacts that are listed on the FOA page.

Where can we find the costs of your NSUF access, including HPC resources, so we can draft an appropriate request?

You'll be able to go anywhere on the website to find NSUF access cost. That's what the NSUF feasibility process is for. If you review Appendix E, that will help clarify how that process works. One of the initial steps is developing statement of work which defines the scope of the access request. Once we've defined that, we're able to do cost estimates at each facility to determine what the cost of the proposal will be. So this process kicks off, essentially, with the Letter of Intent, then the NSUF staff works with the applicants through the pre-application process, all the way up to the submittal of the full application, to develop those costs, help the applicant understand what they're asking for, what things cost, and adjust their application as necessary to be what they think is competitive prior to submissions.

We hope to eventually, in the nuclear energy infrastructure database, which will have this type of information associated with all capabilities. The hope is to have it fully populated so that you will be able to know how much X time on X instrument is going to cost, but again this all comes from the facilities themselves, the willingness to give this information that they've developed themselves. At this point, and probably for the foreseeable future, establishing a cost for any particular project runs directly through the NSUF negotiation and relationship.

As you're putting your application in, no budget documents are required for NSUF-2 Access Only. You'll see that they're available on the form but are not required.

A previous presentation mentioned the FOA release on September 1st. The NSUF LOI is due on August 29th. Am I reading this correctly? Or is there a different FOA?

The infrastructure activity, is a separate FOA, and a letter of intent is not required for the Infrastructure FOA.

The infrastructure application, which is on a completely different schedule than the CINR FOA, is submitted through www.grants.gov, whereas the CINR is submitted through the NEUP website.

Do you expect us to finish all pre-irradiation work to submit an LOI for irradiation-related studies at a NSUF facility?

No. As we go through the process with the pre-application, you will be working with a technical lead. We'll get a better understanding of where you stand as far as the preliminary work that needs to be done. If you're invited to give a full application, that's a much longer process; however, at any time during that time period, if we establish that you are not going to be ready at the time of submittal of the proposal, then we will strongly recommend that you stop with the proposal process until you get to that point. But just at the LOI, if you have high confidence that you will meet these requirements for

the materials by the full proposal time, then I encourage you to go forward. Key word: high confidence.

As a reminder, we have talked about two different FOAs here, so just to reiterate, there is an Infrastructure FOA, number 0001516, and there's a CINR FOA, number 0001515. The CINR FOA is related to the presentation that was just given. That's where you'll find the NSUF-1 and NSUF-2 workscopes. The Infrastructure FOA that was outlined in the previous presentation, those applications are due on November 23rd and that FOA will be released in September. The CINR FOA is anticipated to be released by the end of this week.

Scientific Infrastructure Support Overview

What is the procedure to contribute legacy irradiated material to the NSUF library?

The very first thing is to contact us, and then we will discuss where the material is, what the conditions are, etc. We don't have formal process yet for putting the material in. One of the things is that, in order to come into the library, DOE has to take ownership of that. So, that has to be accepted, so after that there will be a formal transfer of ownership if it is not already owned by DOE. We'll talk about the cost of bringing it, what needs to be done, is there some maintenance, un-packaging. Basically, the first step is to contact me or contact Dan Ogden, who is a deputy (Rory.Kennedy@inl.gov; Dan.Ogden@inl.gov).

I just registered for the NEID, but when I log in, all I see is a landing page with no database. Is there a date that the datebase is scheduled to go online?

There is a time delay from when you register and when you receive access because access requires approval from an NSUF administer.

There is a browse data button on the top of the database and if you click that browse data or search button, it should enter you into the database if you have access already.

Access is usually given within a couple of days. Usually it's short; it runs through Brenden. He does a short check to make sure you are who you are, and then you're given access immediately. Certainly within a couple of days, typically minutes.

Is there an infrastructure gap analysis report from the results of the RFI?

Yes, there is a gap analysis report but at this moment, it is official use only, so it's only in the hands of the Department of Energy.

Is it anticipated that the report will be released publically at some point?

Generally speaking, I would say "yes" but it all depends. There has to be reviews of security and other things for export control before any release like that happens, and

we're in the process of that. So, generally speaking, I would say "yes" but the timeframe for that I can't address.

Are there going to be additional calls for the GAIN Voucher program using the NEID?

The NEID is available through the GAIN website. We have a button there that you can click and have direct access to the NEID. I'm not in charge of the GAIN initiative, but I would anticipate that vouchers may very well come out. When they come out, I recommend using the NEID to help with that.

RC-1 & RC-3 Overviews

Will In-Situ corrosion under irradiation experiments be of interest in RC-1?

For the liquid coolants? Of interest, yes, however, let me make sure the focus of that topic is understood. Our primary interest in that topic is to understand whether the materials that are currently in the code are going to be sufficient or building the components for those systems and if not, what alternate materials may be appropriate and/or what changes to the code analytical and design methods are going to be required for things such as coatings or claddings. Now, if in determining the corrosion allowance that is required vs. the design life it is critical to understand what the corrosion is under irradiation that would be a piece of determining whether the existing or proposed materials would meet those goals and what might be required to make the changes. Irradiation effects are not considered by the code but in determining what materials might or might not be sufficient to meet the design requirements (i.e. corrosion limits over lifetime) that would be useful to find out as long as the rest of that topic were addressed.

Should we consider all of the liquids (i.e. salt and metal) in the RC-1 proposal? Or would that be more appropriate for two proposals?

I believe that there would only be a single award topic per organization, maybe I'm mistaken but I think it would be appropriate to consider all of the aspects in a single proposal whether it was for one coolant or more than one coolant.

For SiC/SiC degradation in RC-3 is oxidation assisted degradation a critical mechanism?

Absolutely.

This PI would like to confirm that graphite is not a focus of RC-1?

Graphite is not a focus of RC-1.

Under RC-1, what are possible examples of alternate materials and design methods?

Some of the ones I listed. Possibilities, although I am not endorsing these but have heard the community discuss. The use of Hastelloy N for liquid salt service. It was a materials that was used to build the Molten Salt Demonstration Unit way back in the 60s and it performed well but is not in the code. So that would be an example, and there are a number of materials that have been evaluated for liquid lead service and particularly the high-silicon and high-aluminum modified steels which seem to have higher corrosion resistance in liquid lead, but they also are not approved for construction in ASME code. Another couple of approaches that have been proposed are to take some of the existing materials, such as the stainless steels or alloy 800H or even 617 once it is approved and coat those with a corrosion resistant materials such as nickel for liquid salt service or even hastelloy N as a clad layer. Some of the questions that would arise from doing that relate to the rules for design and use of a clad structure where the thermal expansion and contration of the cladding vs. the base metal would have to be considered. Those rules do not exist in the code. Another issue that would have to be considered is diffusion of species through the clad layer into the base metal and what affect that might have on overall corrosion. On the other hand there have been some coatings that have been proposed and developed that appear to be self-healing but they are developed on materials that are not within the code. There are lots of innovative approaches, the question is can any of these be codified and if so, what would be the process in sufficient detail that we could develop a plan with the resources and time available to go ahead and put that ahead in place so the designers could use that going forward.

Are you looking for long-term tests using liquid loops, or short term tests?

It's a three year program so I don't think you can do any long-term tests in the timeframe. I guess that would be up to discretion of the proposer on how they wanted to allocate their time and resources between examining the fairly extensive data that is available that others have already done and augmenting that with testing with any kind of testing they may want to do. They would compare that with anticipated corrosion allowance and then developing the modifications and any changes that are required into the code along with a sufficient detail to understand what that pathway would involve.

Under RC-3 is fuel cladding the main focus?

No, fuel cladding is not the focus of RC-3. Structural materials for Gen-IV reactors is the focus. We recognize that SiC-SiC is being considered as an accident tolerant fuel cladding, but that is not the focus of this work. There is not a code requirement for fuel cladding. The code requirements are for structural materials. However, degradation mechanisms would possibly related to fuel cladding work and I'm sure would be of interest to the folks in the accident tolerant fuel world.

I understand one of the five approved ASME listed material has to be included in the proposal?

They should be assessed for suitability. But information solicited in the work scope are only required for those that are deemed suitable for the combination of lifetime, temperature, coolant, and reactor structural component.

Can other candidate materials suitable for the LBE or molten salt environment be included as options?

Yes.

Do LBE and molten salt environments both need to be included in the proposal?

Work scope states "lead (lead-bismuth) cooled OR salt-cooled reactors." If a proposal involves both reactor types, it is also acceptable.

If a proposal aims to assess the high temperature corrosion rate of the candidate materials in a long term corrosion experiment, what's the typical expected time scale for these experiments?

That type of a proposal is much longer than the three-year project duration. But there could be literature data available for longer times, or there are novel methods that are proposed to extrapolate short term results, or short term data can be generated to demonstrate feasibility/suitability and a detailed path forward plan is developed to generate necessary data/information.

Will their corrosion properties be more interesting or useful under irradiation? Has that been considered in future FOAs or is it completely irrelevant to this current topic?

For some structural components closer to the reactor core, irradiation and corrosion could be synergistic. With the planned award amount and project duration, a proposal needs to demonstrate that it is credible to execute and complete the proposed tasks, whatever they are.

Is there any publication on the topic by GAIN initiative, NEI or EPRI? If possible, who would be the person to contact at each institute?

You can check the GAIN website: https://gain.inl.gov/SitePages/Home.aspx, for contact information. Likewise for NEI and EPRI.

In RC-1, does this refer to liquid metal? Molten salt? (or supercritical reactors?)

Liquid cooled reactors include liquid metal reactors and molten/liquid salt reactors. For liquid metal reactors, RC-1 focuses on lead and lead-bismuth cooled reactors.

For molten/liquid salt reactors, RC-1 focuses on those with liquid fuel where the fuel is dissolved in the salt and circulates through the primary circuit (MSR) and those with solid fuel where the liquid (molten) salt is the coolant (FHR).

Supercritical water or supercritical CO2 as coolants are outside the scope of RC-1 so they are not included.

In RC-3, What chemical environments are of interest?

Fluoride salts, liquid sodium, liquid metal, and helium are the chemical environment of interest for Molten Salt Reactors, Sodium Fast Reactors, Lead(-Bismuth) Fast Reactor, and Very High Temperature / Gas Fast Reactors, respectively.

In RC-3, What is the critical degradation mechanism expected for SiC composites in advanced reactor applications?

Time-dependent crack growth assisted by chemical environments (most commonly oxidative), stress, radiation, and high temperature is considered the critical degradation mechanism. However, the effect of radiation is not included in scope of the current call.

In RC-3, How can this project best support the composite design code development in ASME code committee?

There may be many ways for the project to contribute to the ASME code development. Suggested options include development a non-mandatory appendix document describing the time-dependent failure in the pertinent chemical environment or development of ASTM standards for relevant tests.

In RC-3, What components in advanced reactors are considered to be built with SiC composites? Is water reactor fuel cladding within the scope?

Use of SiC composites is considered for components of core structures and reaction control systems in Molten Salt Reactors, Sodium Fast Reactors, Lead(-Bismuth) Fast Reactor, Very High Temperature Reactors, and Gas Fast Reactors. Such components range from the control rod sheath in VHTR to core barrel for MSR. Fuel cladding is not focus but may be integrated into core structures in certain design concepts. Accident-tolerant fuels for water reactors are out of scope.

In RC-3, what is desired lifetime for SiC composite core components?

Most of the core structural components are desired to survive the entire life of reactor whenever possible. Some components that are closely associated with fuels may be changed out upon refueling.

I was wondering if materials of interest would be provided so that we can use techniques to evaluate those materials?

We don't know what would be the right combinations of base and clad materials that would work for the different corrosive coolants (lead, lead-bismuth, different kinds of salts) that we are interested in. This is the objectives of the call for the universities to provide us with the input and to address the issues that we laid out in the FOA.

Depending on the materials that you recommend for applications in these coolant environments, we may or may not have the materials that can be provided to the successful proposal.

We want to study the corrosion effects on cladded ferritic/martensitic steel in molten lead environment. Is this acceptable?

As has been stated in the FOA, the development of ASME Section III Div 5, Subsection HB, Subpart B design rules, and testing articles, testing procedures and test data that are relevant to support these new rules, are of great interest for the cladded structure approach.

Modifications of existing Sec III Div 5 design rules to include novel materials approaches, such as bimetallic structures or clad structures, may be evaluated. Rules for the design and construction of cladded components are provided in ASME Sec VIII for non-nuclear pressure vessel applications and ASTM specifications for various clad steel plates are also available. However, current Section III Code rules for cladded structural components in elevated temperature service have been assessed as delinquent in several areas. Most notably in Div 5 Paragraph HBB- 3227.8(d) where it requires that the cladding shall be considered in calculations related to limitations on deformation controlled quantities, i.e. cyclic loading, but does not provide guidance or requirements for that assessment. Effects of thermal stress from thermal property mismatch must also be considered.

Depending on the base materials and clad materials, what need to be looked at are also stated in the FOA, which is also quoted below.

For candidate materials already included as approved for high temperature usage in Section III Division 5, this assessment shall consist of a determination of the type(s), rate(s) and overall allowance(s) of corrosion likely to occur for the primary system component(s) anticipated to be constructed of the candidate materials compared to the anticipated lifetimes for the specific components. For example, a reactor pressure vessel might be anticipated to serve the full 60-year life of the reactor, whereas a heat exchanger might be anticipated to be replaced every seven to ten years.

For candidate materials not already approved for use within Div 5, a sufficiently detailed pathway needs to be described that that would result in approved Code usage of the material for high temperature reactor applications.

Approval of new base metals and associated weldments that have the required corrosion resistance and elevated temperature strength, and in accordance with the requirements of Division 5, Appendix HBB-Y for pressure boundary and core support structures, will require comprehensive and very long term test data.

Lastly, the final words in the call pretty much summarize what the outcome of the research should support.

Overall project results should include all experimental and analytical extrapolations of corrosion effects versus anticipated service lives for recommended materials. Any required modifications of the Code materials or design methods should be described in sufficient detail as to include a rough order of magnitude of the time and level of resources required for the Code modifications to be made.

RC-2 Overview

Will the projects have to involve neutron irradiated samples?

That could be proposed if the university wants to do that but most of the test reactors at universities are low-fluence so that may not necessarily be adequate. If they have a very good technical proposal where they would like to, for instance, use a sphere for material and irradiate it that might be fine as long as they get enough fluence on the tests and they can do this within the three year period. Again, this could be done as a benchmark and also used to compare what we have at the laboratories from our graphite and TRISO work. We won't send archive compacts to universities to be irradiated in TRIGAs for instance. There is no reason to do that. But we do have samples of graphitic material and matrix materials so if a university wants to irradiate that, that would be fine as long as it complies within the NEUP boundaries.

Does this workscope support modeling or computer simulations?

That could be done. I would like to warn folks that we have had some first principles ab-initio modeling of fission product work done and chemical species done in previous NERI and NEUP proposals. So if that work is repeated we won't really score it highly. The purpose of this is not to just do ab-initio modeling or diffusion modeling. We have that capability already. It can support some of it but it should be done with experimental results. So again, the purpose of this is not to build models, it is to do the experiments, but if you need to do some modeling for the experiment then that needs to be addressed carefully in your proposal.

How far off are the existing diffusion coefficients?

We have some published papers and we also have some papers that will show up in HTR 2016 this year that will also be part of the embedded topical at the ANS meeting. Some of them are off by a factor of 10. We also have had other papers presented in previous high

temperature reactor meetings. Paul Demokowicz can help you get access to the currently published papers and again we will have presentations at the HTR meeting with the ANS meeting so that you can ask questions during that meeting in time to submit your full applications. Hopefully that will help you how some of these diffusion coefficients and some of the previous data is not adequate.

Will I be able to access neutron irradiated samples from the AGR experiments at INL?

You can have access to them. Some of them have already been prepared and are available through the AGR microscopy team. Dr. Isabella Van Rooyen has these ready. We also have others in preparation at ORNL. Paul Demokowicz could also tell you the availability of those samples. We would prefer that the samples, for instance, could be evaluated during summer time or specific time during the academic year. Transporting radioactive samples to universities can be tricky but we do have archived material and irradiated samples.

RC-4 Overview

On RC-4.1, are you looking for computational CFD datasets or experimental datasets?

I believe we are looking for both. I think it is stated that we are open to the computational as well as the experimental datasets. The real intent here is finding a good validation basis for the NEAMS tools that are being developed by DOE-NE. The specific code that we are trying to validate is NEK-5000. We have done some code to code comparisons in the past if you look at the document in Appendix A you will see a reference for that. We are looking forward to getting some experimental data to validate those codes, not further verification. Experiments are encouraged.

The same is true for the High Temperature Reactor. We are trying to acquire sufficient data to validate whoever is using a code for a high temperature reactor design. Data is our highest priority but we realize that to gather data like this you will want to do pre- and post- test comparisons with your own codes so we will expect both.

How many awards are anticipated and how would they be divided between the reactor designs?

We can't say that for sure. We awarded at least one for each area last year. Just to give a scale for 4.1 there were two awards, and one award the previous year. In HTR we usually awarded two perhaps three depending on which year it was and the funding levels.

For RC-4.3 will experimental work be entertained?

I think experimental work is always highly sought after, especially if it will help us verify our models. If you look at the optical absorption elements of this I don't see how you could generate the data without experiments.

Considering the challenges with working with alkali-liquid metals, would you consider experiments with wire-wrapped geometries with other fluids?

Other fluids meaning other than sodium? We are focused on Sodium Fast Cooled Reactors. We would need to understand what other liquids you are looking at. We would definitely consider alternative fuels. The key there is a low Prantl number. The fluid proposed should have very high conductivity.

RC-5 Overview

Do proposals to RC-5 have to address all three issues (metals, cables, and concrete)?

No, these should be separate. These are areas that have been identified by the LWRS program. It provides an opportunity for infusion of new ideas as well, maybe techniques that are being developed such as in the x-ray tomography or medical tomography areas that could be helpful to concrete NDE.

Are enhanced radiographic techniques of interest?

I don't think they have been utilized as much. I'm not sure how accurate they would really beat measuring the specific depth we are in need of looking at. The penetration issues may be problematic.

In the RC-5 call, viscoelastic inverstion methods for concrete are mentioned. Is this a firm requirement?

No, that is an example.

Are you interested in other advanced metallic materials that may not be listed in the presentation?

Some of that is covered in the NE topic areas that will be discussed in a little bit. That is looking at some advanced replacement or advanced radiation resistant materials. So really for the metallic portion of RC-5 I'm interested in the weldments.

Does RC-5 accept computer modeling projects for predicting radiation assisted stress corrosion cracking? Or should they go to NEAMS?

I think wed be interested in looking at it. I don't see any reason why we would be opposed to looking at it. Certainly, when you look at the methodology approach when you are looking at merging both experimental and modeling in together into one very nice part of the LWRS program then it really effectively does that, much more than other

programs that I'm seeing or have expeience with. Modeling support is of interest. The focus is on materials degradation and how you could model that using our computer model. IF the focus is on novel methods of modeling that is more computer science based that would be of more interest than NEAMS, if it's not focused on the materials but rather on the methods for modeling.

Are any of the studies for materials aging and degradation specific to the Advanced Test Reactor?

No.

Do we need to investigate weldment failure with or without irradiation? Or is only one of those enough for the proposal?

Radiation will play and important role. How that affects overall performance in material is important. I wouldn't necessarily discount it or disregard it at this point. If a proposal fundamentally addresses a SCC issue or an environmental fatigue issues that could further be utilized for improvements and understanding the baseline. That will be further useful for radiation effects. I wouldn't completely discount it but radiation is going to play an important role in long-term performance.

Is pre-stressing cables corrosion of interest?

Corrosion of the steel rebar is of interest. It is being looked at by EPRI I believe. It's not a major issue right now for LWRS because we are trying to understand the concrete more itself and not yet the concrete rebar interactions at this point. If it is a NDE technique that allows us to look at and evaluate more corrosion aspects between the two I would say that would be helpful and useful.

Are super alloys considered in this program?

That falls into another call, which we will get to later.

Are the metallic materials provided for our testing for RC-5?

No.

For radiography and tomography what spatial resolutions of are interest?

Most of the flaws are going to be larger sized changes caused by the effects. It could be the millimeter-sized scale for cracks. Cracks can be very significant and woven into the structure but there is also questions of whether you can monitor things such as ASR affects which are a little more subtle but can happen over a more global area.

Is concrete aging still of interest? Or is it only through collaborators through EPRI and NRC?

LWRS always has been collaborating with EPRI and NRC on several areas. Concrete is one of those areas and there are a variety of issues that still need to be addressed with some uncertainty and some unknowns concerning performance. It is still an area that we are interested in.

Are you looking for specific types of defects or degradation in concrete?

No, not specific.

In the RC-5 call, two specific calls for concrete are listed: one on large structures and the other on multi-element ultrasonic array inversion. Are these separate calls?

One is more software driven, whether you can model and assess through current technologies with better resolution of the defects in the materials. The other one is looking at hardware changes, like changing the array size or making changes to the detection system itself and to see if it has any benefits.

On the second call is that exclusively limited to ultrasonic arrays?

No.

Is technology for detecting and evaluating flow assisted corrosion in piping of interest?

No, not on this specific call.

Are there mechanical testing facilities through NSUF, which may be used to support work on irradiated materials tested for this program?

Yes, there are locations available through the national labs that are part of the NSUF organization.

Does irradiation refer to neutron or ion irradiation?

For this call it can be ion irradiation because of the information that is available at this time on effects on welds. For the other NSUF call it will be more specific to neutron irradiations.

Are modeling procedures focused on other concrete degradation mechanisms? E.g. creep induced cracking or ASR induced expansions.

Yes.

Does SCC refer to crack growth rate tests or crack initation tests?

Both. We are interested in initiation effects and what is the mechanism behind it. Then we for crack growth through the material is probably secondary in importance but still requiring understanding particularly when it comes to chemistry issues.

It sounds like you would like to see how existing defects in concrete change and grow with time. Am I understanding that correctly?

It is an area of interest to LWRS but it is not specific to the RC-5 call.

Is the concrete degradation of spent fuel pool walls adjacent to extreme gamma field from spent fuel long-term storage included in RC-5?

NDE techniques would be useful but in terms of a specific task area of interest that is an area that EPRI has been looking at. If a NDE technique is developed to help evaluate that then it would be of interest to the overall nuclear field so, yes, if there are NDE techniques that could dramatically improve detection methods it would be useful.

Is probabilistic modeling in predicting damage progression of interest?

Not specifically on this call.

Is UK participating in any of these areas for RC-5?

Yes.

How many awards are anticipated for RC-5?

It depends on the quality of applications we receive. Two or three are possible.

On degradation testing, would destructive testing (e.g. pulling physical samples for spent fuel pool research) be allowable?

No.

RC-6 Overview

No Questions

RC-7 Overview

Would this include decay heat modeling?

No, I'm looking around to make sure but I think decay heat is pretty well understood.

Is there interest for studies with intact fuel rods or just degraded debris?

Degraded debris was the focus because that is where the uncertainties are. When you look at severe accident beyond design basis modeling that is where you see divergence of predictions.

Are you interested in corium relocation modeling?

Yes.

For experiments with raw water, what operational conditions are of interest?

I'm not sure what that means. Raw water means not what is usually used in reactor cooling. Deionized, it could be anything from essentially surface water used on the plant side, storage water which is not directly injected all the way to sea water. So anything other than normal operational water chemistry and what happens to that once it is injected. Would it boil off and would contaminates create blockages, etc.

Will it be possible through this workscope to do onsite work at Fukushima?

No.

Are you interested in precipitation of salts?

Yes.

As a follow-up to the operational conditions question, what are heat and pressure conditions?

Heat addition and pressure could affect formation of blockages and also the ability to cool either the steam or water, so yes it would be of interest.

RC-8 and RC-9 Overview

Are dynamic models connected to RELAP-5 3D platforms of interest?

Probably not. The only information that would use a RELAP-5 calculation are those that we could use to benchmark a RELAP-7 calculation. We could leverage that from an existing model if needed.

In RC-8 are you looking for better physics models for the system (for example CRUD development and its influence on heat transfer)?

That's looking more at leverage the existing risk information into the simulation, so less at new physics models unless those models were built in to one of the static models which we could use for a dynamic model.

In both areas are you interested in new efficient Monte Carlo methods to greatly reduce statistical sampling errors for RISMC?

Not in this call. That would be more algorithm development, which is not part of this call.

Are you looking for industry created models to assist in benchmarking?

Yes. In fact the existing static models would be the industry models to looking for partners to leverage those models would be encouraged.

NSUF-1.1a & NSUF-1.1b Overview

In NSUF-1.1a, would you be interested in grade 91 steel?

Yes.

Are you interested in sequential radiation and thermal effects studies or parallel radiation and thermal effects of CASS?

Yes because there is definitely a challenge to address this issue of synergistic effects. The approach has been an area that has been aided by a number of people back and forth quite a bit. We're open to different techniques or methods to approach this issue, but there is going to have to be some scrutiny and justification for the approaches provided.

MS-RC-1 Overview

How many pre-proposals were there last year and how many awards were there last year?

About a dozen pre-proposals and one award.

Are any of the current advanced reactor technologies aimed at replacing the Advanced Test Reactor?

That is something I don't know off the top of my head. I would say given the nature of this particular call not directly. But if there is some good ideas on what another test reactor or advancement of the ATR would look like we could certainly entertain that.

Are partnerships with industry or national laboratories required for this workscope?

Not required, but highly encouraged.

Would advanced fuel for actinide recycle in LWRs be of interest?

We are generally focused on non-LWRs.

What level of mobility are you defining as a mobile reactor?

That is a question I don't usually get. It can fall within how the mission would be defined. If a mobile reactor would be for a remote outpost that could be something that would be mobile or remote that could power at the 10MW level. It could be smaller if it is for a farm maybe pumping water for irrigation in remote locations. There isn't a specific definition for remote it depends on how you contextualize the mission of your concept.

Will non-power research reactor designs be supported?

Generally yes, but of course we will have to look at the details of the proposal.

Is there one reactor type in particular which will be a major focus this year?

No, we don't have a specific reactor type that we are focused on.

Are FHRs being deemphasized in this call due to recent awards on this concept?

I would not say that. We are looking at both FHRs with the solid fuel and we are also interested in what industry has shown interest in which is the liquid fuel reactors.

I wonder if the proposal here will be incorporated into the proposed small modular reactor to be sited at INL in conjunction with NuScale.

We will have to look at what details you are talking about. Some areas can be applied to LWRs or SMRs but again, I'm not sure what details you are referring to.

MS-RC-2 Overview

Are you interested in computational work for space reactor designs?

I don't think we are after that this year. We are looking more for actual physical designs.

What is the expected funding level for this program?

The proposals can be up to $400,000. Go for the $400k limit.

What lifetime are you considering for the portable terrestrial reactor?

When we were doing the space reactor design we were looking for an 8-year life. A portable terrestrial reactor would have a rougher life, probably a 5-year design, which is a guess on that.

Does the proposal need to cover both the fuel design and energy conversion systems?

It does not.

How many awards do you expect in this area?

I want to let people know that this is my third year of doing these presentations and we have made awards in each of the past two years. Don't assume because this is some wacky technology that is far out there that an award won't be made because depending on the quality of your submissions you very well could win.

Is UN considered a developed fuel by your definition?

Uranium nitride? I think it is, not quite like an oxide form but people are aware of its characteristics.

IRP-RC-1 Overview

If collaborations with DOE labs are essential, is that the same for industry?

Actually I don't believe I said DOE labs are essential. What I said was collaboration with the NEUP projects is essential. A good resource would be to look at the report that was published last year and the reference is given in the presentation. It is an ORNL report but the principal author on that is Jim Nestell and Sam Sham also contributed to that. It is not principally work from the national lab, it's more from a code perspective than the national lab perspective.

What is shown on the screen, what we are looking for is interaction with ongoing NEUP projects and also more importantly in terms of some of those in surface inspections, post construction examinations, so collaborations to bring some of the ASME subject matter experts into your team will be highly encouraged. There are a number of competitive manufacturers which are three pieces that are an integral part of this IRP. To bring all of these parties to bear will be critical to the success of the project.

FC-1 – Material Recovery and Waste Form Development Program / Advanced Material Technologies Program

Are electrochemical separation technologies that operate in aqueous environments of interest under the call?

Yes, it would be of interest.

Are zirconium dioxide waste forms of interest under the call?

No, it's only the glass waste forms.

When and how do we get information about the "Blue Sky" call?

The Blue Sky call is coming soon. It's my colleague, Bill McCaughey…tomorrow at 3:30 pm ET.

What is meant by the "commercial"? If it is commercial waste from nuclear power production, what are the composition ranges DOE is interested in?

We are interested in glasses generated from commercial used nuclear fuel reprocessing rather than defense waste glasses. Closed Fuel Cycle Waste Treatment Strategy, PNNL-24114 would be helpful (refer to table 3.4). This report also gives useful background information that may help in your proposal and understanding of the program.

FC-2 – Advanced Fuels

Where can one find documentation on previous NEUPs?

Go to www.neup.gov. We provided a lot of background slides that include the NEUP website as well as various documents and websites on the Advanced Fuels campaign.

Those documents can be found under the R&D tab and they're titled, "Funded Projects."

Does my proposal need to be on HT-9 or any metallic material having advanced properties?

So any metal alloy concept. You can look at variations of HT-9 but we're open to any advanced concepts that you can prove the feasibility and the irradiation performance on. It has to be a metal alloy.

Are Zr alloy cladding materials included?

The statement that Zr cladding would not be of interest applied to FC 2.2 (Extreme performance metal alloy cladding for fast reactors) and does not apply to FC 2.3 (CHF for ATF). In terms of the advanced fuels program interest in Zr cladding, we would primarily be interested in coated Zr claddings utilizing coatings that are currently of importance to the program. Current Zr cladding presently in use in LWRs today would only be of interest as a point of reference and to validate your approach. There are also other ATF cladding concepts besides coated Zr that would be of interest. Slides 18-19 of the August 8, 2016 presentation on FC 2 details the specific cladding materials that were found to be promising during Phase 1 of the Accident Tolerant Fuels Program. This presentation can be found at: https://neup.inl.gov/SiteAssets/FY_2017_Documents/FY17%20Webinar%20Presentations/FC2_2017_CINR.pdf. In addition, applicants are highly encouraged to conduct a thorough literature search including and beyond DOE reports. The university may partner/arrive at collaborative agreement with other universities, industry partners, or national labs to acquire the ATF cladding materials of interest.

Will it be acceptable to have simulated PWR conditions without nuclear radiation for CHF testing rather than actual reactor conditions with nuclear radiation?

Yes it is acceptable to have simulated PWR conditions without nuclear radiation for CHF testing. We would expect that tests would not be conducted in-pile and would be under simulated out-of-pile conditions since the budget will likely not allow for any meaningful work in-pile. If you do decide to propose in-pile testing, a description of what would be gained from in-pile testing and a credible cost estimate must be included in your proposal.

Which nuclear facility we can approach for carrying out the tests under real nuclear reactor conditions and does the testing cost has to be covered from the NEUP project budget?

As mentioned in question 2, out of pile testing is sufficient. If you do propose in-pile testing, the cost must be covered from the NEUP project budget. Access funding provided to the lab out of your NEUP allotment can only account for 20% of your total budget. Alternatively if you do have R&D funding already identified and available outside of the FY17 CINR solicitation, you may apply to the NSUF access only work scope area for irradiation services only. You may NOT simultaneously apply to FC 2.3 and NSUF.

Would enhanced methods for poolside examination that extend current technology, e.g., spectro radiography and tomography, be of interest in this call?

Yes, definitely it will.

There is a ORNL report in collaboration with university partner on this topic as noted below. How others could compete if DOE has already funded ongoing project in this area?

ORNL/TM-2016/252; Survey of Thermal-Fluids Evaluation and Confirmatory Experimental Validation Requirements of Accident Tolerant Cladding Concepts with Focus on Boiling Heat Transfer
Characteristics by N. R. Brown, A. J. Wysocki, K. A. Terrani; Oak Ridge National Laboratory and A. Ali, M. Liu, E. Blandford; University of New Mexico; Prepared for U. S. Department of Energy
Office of Nuclear Energy; June 2016; M3FT-

This report should be used along with many other instances in the literature as a guiding background for the upcoming research. This report did not fully address the needs raised in this call since no actual CHF tests, or any high temperature tests, were conducted. The report consists of a literature review, a set of scoping analyses, and wettability (static advancing contact angle) measurements for ATF cladding samples.

Which nuclear facility we can approach for carrying out the tests under real nuclear reactor conditions and does the testing cost has to be covered from the NEUP project budget?

There should not be any in-pile tests. The budget will not allow for any meaningful work in-pile.

Can you please specify which DOE developed code would be suitable for this project?

Both DOE-NE and NRC developed thermal hydraulic systems and sub channels codes are acceptable. Model/correlation outputs should be compatible with industry standard state of the art modeling tools and should also be applicable to modeling and simulation tools currently in use or under development by DOE-NE or the NRC. Some examples of existing codes are TRACE and RELAP. Ultimately data produced would need to be incorporated into the Moose-Bison-Marmot fuel performance code under development by DOE.

Can you please direct us to any other DOE report related to this topic?
Please refer to slide 16 of the August 8, 2016 presentation on FC 2 which lists recent advanced fuels campaign documents. You may also visit the advanced fuels website at https://nuclearfuel.inl.gov. In addition, applicants are highly encouraged to conduct a thorough literature search including and beyond DOE reports. All DOE publications in the area of ATF are open to the public.

Could you please provide some contacts at DOE site who may be able to provide us some samples of ATF cladding materials?

Kurt Terrani at ORNL will be able to provide FeCrAl material. His email address is terranika@ornl.gov

Contact information for the industry vendors are listed below. Please refer to slide 18 of the August 8, 2016 presentation on FC 2 for details on which vendor is interested in particular cladding materials.

Westinghouse: Ed Lahoda lahodaej@westinghouse.com
AREVA: Mike Morrell mike.morrell@areva.com
GE: Raul Rebak rebak@ge.com

Could you please provide contacts for DOE labs who may be able to helps us in regard to testing under simulating conditions of PWR/BWR? I am assuming that room temperature measurements of critical heat flux would not be sufficient and proposal is calling for testing under temperature and pressures in PWR/BWR conditions.

There are numerous national labs, industry partners and universities which can provide relevant testing conditions. Please note that no more than 20% of NEUP funds may go to non-university institutions. The program contact at ORNL is Dr. Kurt Terrani and his email address isterranika@ornl.gov. The program contact at INL is Dr. Daniel Wachs and his email address is daniel.wachs@inl.gov.

FC-3 – Advanced Process Monitoring for Domestic Nuclear Safeguards

Would enhanced radiographic methods for quantitative material accountability be of interest?

Possibly, but what I'm familiar with radiographs, that's hard to tell the composition of a fuel assembly or something like that. What we're talking about more here is the chemical process, which is dynamic, so we would be looking for near real-time accountancy, so if radiography can be applied to that in an interesting way, then we would be interested. But a static measurement of, let's say, a fuel assembly, probably not so much.

Is there a particular system you'd like to see technologies developed for?

Well, we're focused here on potential reprocessing systems. As far as detector system, no. People have used gamma—you can do more isotopics with gamma—but neutron techniques are also valuable for getting total fissile content, things like that. And, traditionally, optical methods—Raman spectroscopy, UV vis, high res—those types of non-radiation signatures, but no, not a specific system other than one that can be applied to a chemical separation process.

FC-4 – Used Nuclear Fuel Disposition

Would gas transport from the geosphere under barometric cycling be of interest?

Yes.

Is there a required breakdown in costs between industry, national laboratories, and universities?

In Appendix A, no more than 20% of budget can go to non-university collaborators, meaning you can do 10% to an industry partner, 10% to a national laboratory partner, etc., so whatever your budget breaks down to, no more than 20%.

Will performance of cladding material during storage be of interest?

Absolutely, that is one of the key areas of interest.

Is saturated and unsaturated transport of interest?

Yes, both saturated and unsaturated are of interest, the reason being that we do not know at this time the medium in which the ultimate repository will be located. At this time, we're pursuing a consent-based siting process, and we will know where and in what medium a repository will be located at a later time.

Would the effect of temperature on capillary pressures in the subsurface be of interest?

Absolutely. Temperature plays a major part in the chemical and hydrologic process, where both chemistry and hydrology would have effects, they are all coupled processes.

Is a working computer model an expected outcome in the three-year timeframe?

Yes.

Is fission product speciation of interest?

Yes.

Are standalone codes of interest, or only modules for existing repository codes?

Standalone codes are of interest; however, I encourage the inquisitor to listen in for the IRPs that we have to present in the next time slot. One of them has to do with next generation thermal-dynamic data development and analysis for nuclear waste repository performance assessment and decision-making. That is a long title, but it has to do with the models and the next generation of data development.

Is there a preference for applications that consider many processes over a more focused proposal?

We are hoping to get an idea of how processes interact because many of them are coupled processes, so coupled processes would be more applicable over the broad range.

How should an application be organized if the topic falls under multiple key needs?

I would leave that up to the offeror to structure their application in the way that they feel would be most beneficial to the needs of the DOE, where we are looking to have an analysis of coupled processes. I cannot dictate that one methodology would be more preferable over another. We would leave that up to the offeror.

Are you interested in novel material for transportation of nuclear waste?

We are not, at this point, soliciting R&D efforts in the transportation area.

MS-FC-1 – Mission Supporting Fuel Cycle Technologies

Are electrochemical separation technologies that operate in aqueous environments of interest?

Yes, and I would probably say yes to whatever questions you have in this area. That's the nature of this area. As long as it's something we are authorized to work on that is generally part of what we do, then yes, we would be interested in that.

Are waste forms other than glass of interest in the call, particularly ceramics such as zirconium dioxide?

Yes.

Is experimenting and modeling the effect of moist rarified helium on S&F temperature during vacuum drying of interest?

Yes, that would certainly be an area of interest in the storage and transportation and used fuel disposition R&D.

Is there any interest for technetium?

Yes.

Can folks with a current IRP apply again this year?

If you have a currently funded IRP as a lead PI, you are not eligible to apply to any part of the FOA. Now if that IRP ends by December 31, 2017, or if you are not the lead PI, then you are eligible to participate.

Is near field geochemistry of disposal sites an area of interest?

Yes.

What elements of near field geochemistry are of interest?

I couldn't answer that. Again, it's Mission Supporting. That is an area of interest for the used fuel disposition research and development. Technically, I couldn't answer that question, but I would say that for this Mission Supporting area, all areas would be open, although I can get back to them on that if they have particular concerns.
Specific technical questions will be sent to Bill the questions and he will forward them to the individuals who conduct the Mission Supporting work who can provide answers to those who can go into more technical detail and provide more specific answers for you.

Where can we find the contact information for the Federal and Technical Points of Contact?

Once this webinar concludes, all contact information for the Federal and Technical points of contact will be available on the NEUP website (www.neup.gov). Phone numbers and email addresses will be provided. These can be found under the R&D and IRP tabs under "Technical Points of Contact."

IRP-FC-1 – Modeling of Spent Fuel Cladding in Storage and Transportation Environments

On the task list that JC spoke to in the presentation, do PIs need to complete all of those tasks, or a subset of those tasks, in the application?

This is a comprehensive program because it's integrated in many respects. We expect all of those tasks to be performed, so when they put a team together, we expect that it's all covered in some form of the other. There's also work going on in this program; we address many other things. This IRP was written mostly to facilitate things that we will see as complementary to what we already have, so the short answer is yes, we have to have all of the tasks addressed.

It looks like you're not wanting to examine the effect of irradiation at this stage, is that correct?

Yes, that is true because what we are trying to also do is to get more of the unirradiated testing done by the universities. We do have programs internally right now working with irradiated materials, so part of our expectation is, by having less irradiated materials need to be tested in the universities circumstances, more folks can participate in this program.

How can we find out more about the ongoing work on which the IRP is based?

One way is for individual folks to contact Mike Billone, who is the Technical Point of Contact. There is also in the literature part of the UFD, which is the Used Fuel Disposition campaign, and there are published reports out there and if you look on the web pages, you might find that. Short of that, if there is a specific request for something, send it to JC and he can probably coordinate that.

Does this IRP workscope involve any experimental work?

Yes, it will involve experimental work because some of that work, if you take for instance, drying out cladding, some of the concerns are the long term effects so there are variations in the issue of the condition of some of these cladding materials particularly when you look at issues with how it's being processed, so initial process factors do have formation variations, so we'd like to know what goes on with that and it will be experimental work to address that.

I don't see any mention of uncertainty quantification. Do you expect any UQ on the simulations?

Yes, we would expect that. Most of this work will have straight models of process, but then when we try to integrate know some of these things, they are uncertainty quantification. Would be an added benefit so we can encourage folks to do that.

IRP-FC-2 – Next Generation Thermodynamic Data Development and Analysis for Nuclear Waste Repository Performance Assessment and Decision Making

Are you interested only in data relevant to current repository models, or is there a broader set of isotopes that is of interest?

It has to be based on the inventory, really, what we have in the BWRs and PWRs and also some of the DOE wastes. There are important isotopes that we are also working on differently. It can be a larger set of isotopes. There is some flexibility in the latitude toward that.

Can that broader set be found somewhere?
Our main interest is to see the radionuclide transport from the source and go through the media into multiple situations like aquifer or anything else, so in that process, we see that many closer to the waste forms with higher temperatures and then we have, so there is a set of radionuclides with long half-life and those with actinides and others that may be there. I don't have the list of the radionuclides that are currently needed, the published reports have quite a few of them. If anybody needs that help, just contact us if there is anything specific you'd like to know.

Is it required, or strongly encouraged, to collaborate with the NEA on this IRP?

Not necessarily, but knowledge of their work, because NEA, the technical database that they are working on is fairly comprehensive, and what we have tried to do in this solicitation is to look at a few things that don't exist in that technical database and eventually, we think if we double-up something here, it will also be into the NEA database. One point I'd like to also make is that most of the ways thermodynamic database have been doubled up way back, you do some experiments and then gives energy or anything else to characterize its performance. We are also thinking, at this stage, to get folks to look at a new generation of out of the box type of thinking, if there are any new ways of looking at it. It's not just developing the information for specific end products, but also if you want to look at a new conceptual framework, we'd like to see that too.

Is there interest in an analysis of reduced order transport models to inform which radionuclides and natural minerals are of greatest interest to understanding repository performance?

Part of the problem with answering that question is that it depends on so many things in the environment. If you assume an environment and then put the reactions in place, there may be—because we're looking at generic repositories—some variability in that. But yes, if an argument is made, we'll look at that too.

Are all tasks to be performed, or just a subset?

It's fairly comprehensive. Because the IRPs are an integrated program, we would like to see all of the tasks addressed.

It was mentioned in the webinar introduction that collaboration with the UK is encouraged. Is this applicable for this IRP?

With the information we have right now, we anticipate that the UK collaboration will only be for Appendix A workscopes, whereas this IRP falls under Appendix C. You could collaborate on an FC-4 project, which was presented about a half hour ago, but you would not be able to have the same opportunity for this IRP.
Please keep in mind, this is information we have right now that won't be finalized until we release the FOA, hopefully later this week.

The workscope includes the words "and Decision Making" at the end of the title. What aspects of this workscope include decision making analysis work?

That's what I was alluding to before. At the end of this, we are looking at performance of radionuclides being transported to some arena. The performance we are looking at maybe a dose rate or something else, so that is where we were driving at from that point of view.

Are only chemical thermodynamic data of interest, or also transport parameters, and how they might be affected by things like temperature?

Less on the transport as much as the chemical issues with high ionic strength and temperature dependency. Those are important things for us. What we are also trying to do is to give the proposers a little more latitude about how they view which one is important. From our point of view, for repository performance, the temperature dependence on these chemical reactions is important and so that we understand very clearly and we are able to better quantify their reactions in terms of transport also, eventually.

The minerals through which things move also matter. Which of those are of interest?

I can't put my finger on it right now. It's the geologic materials that are there. We do have near field bentonite materials probably around the waste package. There is some

man introduced minerals and then the natural field mineralogy, that is crystalline or clay, all solid conditions. So, it's natural minerals mostly and then various components will have things like bentonite and other things in the near field.

Is the development of standardized experimental procedures of interest?

That would be a plus, simply because not only the experiments we do we have to analyze that data. There is a two-step process that is usually used in these databases. Once you develop some data, you have to analyze it in terms of other factors. What we are trying to think through this is, is there an ability to better represent consistently how we analyze the information. The NEA's attempting to do all of that, too, but we've opened it up for the university program to be able to think through what's the best way to be consistent in data development and analysis.

NEAMS-1 Overview

In NEAMS-1.3 is there interest in new methods for quantifying uncertainty in criticality and coupled criticality burn-up simulations that could be used to create modules for existing codes?

Under NEMAS 1.3 call in FY17, performance improvements for only the cross-section generation code, MC2-3, are sought, including the uncertainty evaluations in cross sections. Criticality and coupled criticality burn-up simulations are performed with other neutronics codes such as PROTEUS. Development of the new methods for quantifying uncertainties under PROTEUS is beyond the scope for this call, and will be considered in future years.

How many projects do you anticipate funding in NEAMS-1.1?

That is an interesting question because it is hard to say. We typically have been able to award 5 or 6 projects per year in NEAMS. That can change but that's the typical range. With this number of scopes we would hope to have a representation from each sub-scope so it would be down to just one award per sub-scope but there is also the possibility that two awards in one sub-scope are so good and so needed that we would do that. We definitely want to try to have a broad range of these sub-scopes represented. If funding situation changes and our ability to invest more increases we're not putting a cap on that right now. It's an implicit cap made by our funding restrictions.

In NEAMS-1.4, can DNS be produced by a code other than NEK-5000?

The scope of NEAMS 1.4 call seeks development of URANS or hybrid URANS/LES turbulence models for very low Prandtl number fluids (liquid metal coolants) preferably under NEK5000 code for wire-wrapped SFR rod-bundle configurations and prototypical operating conditions (fully developed forced convection regime). Use of DNS generated data (either by NEK5000 or any other code) to support verification of the developed

turbulence models should only be a supplementary component of this main task (not the main goal of the proposal).

To clarify, the wording 'new tailored DNS datasets encouraged' must be done with NEAMS tools only?

The scope of NEAMS 1.4 call seeks development of URANS or hybrid URANS/LES turbulence models for very low Prandtl number fluids (liquid metal coolants) preferably under NEK5000 code for wire-wrapped SFR rod-bundle configurations and prototypical operating conditions (fully developed forced convection regime). The developed turbulence models can be validated through comparisons with existing experimental data or verified via DNS data generated either by NEK5000 or any other code.

Is there any interest in new high-resolution experimental data for NEAMS-1.4?

The scope of NEAMS 1.4 call seeks development of URANS or hybrid URANS/LES turbulence models for very low Prandtl number fluids (liquid metal coolants) preferably under NEK5000 code for wire-wrapped SFR rod-bundle configurations and prototypical operating conditions (fully developed forced convection regime). The developed turbulence models can be validated through comparisons with existing experimental data. Conducting new experiments are outside the scope of this call. High-resolution experimental data is of significant interest under NEUP RC-4.1 call.

Can the NEAMS-1.1 workscope include experimental work?

Yes. It could. We also are interested in that. I think that goes to improving the validation basis that can be done in a number of ways but we would certainly be interested in proposals that would provide experimental data that would support that. We have another scope that we will be presenting on NSUF but NSUF aren't the only facilities where experiments can be run. In this scope that would be welcome.

How many NEAMS proposals were submitted last year?

I'm tempted to say I lost count but I believe we had 60+ pre-applications and of that we had about 27-30 full proposals.

Is it possible to find a list of currently listed NEUP projects and PIs?

You can find that information on NEUP.gov. Go to the R&D tab, there is a list of years under 'Funded Projects' and NEAMS is its own separate section so they are especially easy to find.

NEAMS-2 Overview

Did you define separate effects?

In real life, multiple physics/phenomena (such as neutronics, thermal-hydraulics, fuel behavior, and thermo-structural response) apply simultaneously and interdependently during operational transients or accident conditions. In "integral tests" such as those conducted in test reactors, interdependence of all of these phenomena can be captured collectively. But such facilities are hard to get, and operators/regulators often limit the severity of the tests that can be achieved with them. Therefore, we often revert to "separate effect tests" where a single (or fewer) physics can be studied in an isolated fashion. For example, in a thermal-hydraulic test using electrically heated rods, we can isolate the thermal and hydraulic behavior without varying about neutronics feedbacks and fuel behavior and, therefore, we can push the envelope for what can be tested. The separate effect tests are also much less expensive than the integral tests. The data from separate effect tests can still be used to support partial validation of computer codes/methods for limited number of physics/phenomena.

Is it essentially the isolation of variables?

Yes.

Where do you find the workbench related report or documents?

So workbench is actually a brand new concept for NEAMS that we just proposed in the last few months beginning with a NEAMS leadership council meeting in January we decided to undertake this initiative. There is very little documentation available for it. Part of it is based on the user interface the scale code system, which has documentation in that context. If you need additional information of workbench and the concept of templating, it is deployed with the UNF standards tool which comes out of the NE-5 used fuel disposition program or email me and I can get you more information.

What is the relationship between NEAMS 1.1 and NEAMS 2? Are they interconnected?

They certainly can be. In NEAMS-1.1 your proposal would not involve use of the NSUF facilities. If you did experimental work it would be done in a different facility, like a university facility. The purpose of this scope is to use NSUF facility this is the path forward for doing that. It is restricted to universities. It's a new area for us but we needed to get into this area to give flexibility to provide proposals that would make use of the NSUF facilities. This is one area that appears to be most relevant. These could overlap with NEAMS-1.1 but the difference is the NSUF.

Can universities lead in this workscope?

Yes, only universities can lead in this workscope. National laboratories and industry partners are encouraged.

Is the proposal expected to address all of the problems or focus on only one?

First of all, is that directed toward the other NEAMS scope? That may be a question for the other NEAMS scopes and I would like to answer that. In this scope it's focused on MARMOT.

The FOA states that it is the PIs responsibility to submit the correct workscope- since NEAMS 1.1 and NEAMS 2 are so closely related, will an exception be made for proposals submitted to one area that would better fit the other?

No. The major difference here is that NEAMS-2 is a NSUF workscope, which requires a LOI to be submitted so that the NSUF staff can start a feasibility review. There is no opportunity, especially in NSUF workscopes, to provide a shift regardless of the circumstances. Let me get to the heart of that question. When there is a fine distinction between scopes someone might make a mistake. There could definitely be proposals that aside from the facility that they use could fit in either NEAMS-1.1 or NEAMS-2. The difference is that if it involves a NSUF facility it must go to NEAMS-2. You can always check with us first and we will answer where it should go.

NEET-1 and NSUF-1.2c Overview

Are there any components of specific interest?

No, we don't have anything specific. One thing that is called out is the silicon-carbide end caps in NSUF-1.2c. Other than that we are leaving it open to see what you think.

Would field assisted sintering be of interest?

Yes.

Is there a target TRL?

No, obviously the upper TRL levels if its specific to a particular component in regards to a reactor design we are not looking for. We look to include technologies and techniques for a broad array of nuclear reactors so more in that medium range, but we don't have a specific TRL range we are looking for.

What components are you interested in for field assisted sintering?

I would have to get back to you on specifics if you would email me at the email address listed on the screen.

Do you fund advanced manufacturing of reactor components with embedded sensors?

Yes we do, we also have the advanced sensors and instrumentation program so it depends on what work needs to be done. Are the sensors and instrumentation already developed and you are trying to incorporate those into the manufacture of the components or are you doing the development work on advanced sensors and instrumentation. It depends where along the product development line that would be.

Would graphite manufacturing be a target application?

I believe so. You would have to get specific into the reactor design. If you make the case that it is applicable to several reactor design then yes.

Are cements of interest in the topic?

AMM has funded several concrete proposals in the past few years, in 2013. Therefore it is not a program priority at the moment, although they have been funded in the past.

Does irradiation testing need to be done with neutrons or would heavey ions bombardment be acceptable?

Both. We offer both neutron and ion irradiations. Our suite of partner capabilities is available on the NSUF.inl.gov website. All of the partner facilities and exactly which capabilities are offered at each facility is listed as well.

Are cermets (ceramic/metal composites) of interest?

I would have to look into that a little more. I'm not a material expert so I would have to consult on that. If you email me I will get back to you.

Friction stir additive manufacturing has been funded in 2016. Are there more opportunities this year on that topic?

There are certainly not opportunities. You have to make the case that it is different than what is already funded. The abstract is already online. I can contact you directly if you need more information. We do not fund multiple techniques if they are duplicative of each other. If it builds upon something or show that it is different than what we currently fund that is acceptable.

Is an industry partner required for NEET-1?

An industry partner is not required. NEET-1 is open to industry, labs, and universities to actually lead the project. We obviously encourage collaboration and we would like it but it is not required.

Is the program targeted toward innovative manufacturing techniques or new material development/manufacturing?

Innovative manufacturing techniques.

Is additive manufacturing of ceramics of interest or only metals?

It's not necessarily only metals but again you have to make the case that it is applicable to a few different varieties of reactor types. I think ceramics would be okay.

How many awards do you anticipate in the area?

We plan on making two awards but that is dependent on budget levels.

How many pre-applications did you get last year?

I think we had about 10-15, possibly but I would have to confirm that.

<u>NEET-2, NSUF-1.2a, 1.2b Overviews</u>

Does NEET-2.1 or NEET-2.2 cover instrumented casks?

We didn't talk about casks specifically but in the first call area (2.1) we left the call pretty broad where we are looking for innovative proposals for nuclear energy applications so it's open. You could apply for casks in that area.

What is the exact definition of 3D sensor network? I'm curious what 3D means in this context?

In the context of this application what we mean is a network of sensors that are applied in a systems context. For example, if we were to monitor piping or if we were to monitor some physical structure it means to be able to interrogate the material with a suite of sensors and integrate that information in-situ. So preserve the 3 dimensional nature of the data from those sensors and use it to make some type of an assessment of the material that it was being applied to. That is what the 3-D nature applies to: the way the sensors were applied to the materials, as well as how the signals would be interrogated coming back from the sensors.

Is sensing the condition of structural graphite be of interest?

We would entertain a proposal in that area that would depend upon how crosscutting it was. If we saw it's relevant to multiple reactors concepts or multiple reactor types long-term than we would be interested in that. Of course we would have to see the context of the proposal. We would talk with the relevant program managers in the different reactor concepts development areas and see how that would scale for what they're interested in and see how NEET can support those programs to that particular application. I would say it's at least worth a pre-application if you can tie it to the goals of the program.

In NEET-2.2, is there interest in 3D radiation monitoring networks for these materials, limited to in-core or ex-core?

I'm not sure we are looking for radiation monitoring. We are trying to figure out measurements and how materials change so monitoring is not targeted. It will depend on how it is proposed. I think we were looking for sensors and suites of sensors that would interrogate the condition of the material more directly. Looking at radiation is the precursor of how the material changes as a result of radiation exposure perhaps, but I may be reading more into the question than I should. I would agree with Suibel, it depends on why they are proposing it and what sense it makes in the context of the proposal. If it's tied to that call area or related to 3D sensor networks for monitoring of a structural material we are interested first and foremost in structural materials. You have to make the case of what you sensor network does and why your measurements are relevant to that application.

How many awards are expected under NEET-2?

I think we are going to try to support 3 awards one for each area, at least that is the target right now depending on the funding in the appropriation.

How is the monitoring of passive components call differ from the work being conducted at Vanderbilt University?

I'm not aware of all the work that is being done at Vanderbilt, but I am aware of some work in support of some research from the LWRS program. That work is studying alkali-silica reactions in concrete so that's a very specific topic. What we are interested in here could be applied to many types of structural components in nuclear energy system from containment structure, steel structures, piping. It could be applied to many differently types of structures. We are certainly not limiting to one single phenomenon.

Does the interpretation of the input from the 3D sensor network required to be included in MOOSE or GRIZZLY software?

I don't think it's necessary to relate the signals, especially the signals coming back with 3D sensor network into the MOOSE or GRIZZLY models. I think it is important to have a good physics model of the structures and systems that you are monitoring and maybe

you would use whatever system for modeling that. If you prefer to use MOOSE and GRIZZLY that is fine, I wouldn't get in to the discussion of what types of codes are most powerful and that. I don't think there is an explicit consideration to tying it to those applications.

Will the 3D sensor network continue multi-modality sensors or a single type?

It could include either or both.

Is material aging modeling to better interpret data from sensors applicable to NEET-2.1?

Not necessarily. I don't think we are only interested in material aging. There can be a number of things that you monitor materials for including their performance in-situ. Aging is just one factor. You can also look at thermal cycling of materials, you can look at various other things that different components in a nuclear energy system go through and monitor that. Piping systems go through a variety of different things that are service induced rather than aging induced, unless you lump everything under aging. It depends on what you consider aging and what you choose to include in your model.

For NEET-2.3, do we need to implement the sensors in the TREAT reactor?

I think that is the ultimate goal. I think if the scope of the project is such that you could reach that point by the end of the project and do a demonstration there I would encourage that. If it's a less mature technology or concept that is a low TRL level and it is not realistic to deploy in a three year window that is reasonable as well. I think that you would want to talk about the trajectory of how to get it to the point of deployment and what would be necessary after the completion of the project to fully evaluate it. Our objective is to see projects that have a harvest strategy.

Is wireless communication and power harvesting of interest to this call?

Usually that is in the communication area. If you can tie it to one of the topics that we discussed, then yes it would be of interest.

Are LWR sensors being investigated under this area or just advance reactors?

It is crosscutting area so we try to find research that applies to multiple areas. If you can make a case for LWRs and something that also applies to advanced reactors that would be applicable.

<u>NE-1 Overview</u>

How many pre-applications were submitted in this area?

For the university call between 10-15.

How many awards are expected in this area?
In the first year we awarded two, we are awarded one last year. We will be in that ballpark next year.

Does the project have to involve the design in LWR/SMR and other reactors?

No. I can add to that. The overall program, when its implemented we will be looking cradle to grave across the entire nuclear fuel cycle. It could be a spent fuel facility, it could be transportation, it could be enrichment facilities, or even a university reactor.

IRP-NE-1 Overview

Is the ten students limit only for graduate students, or both graduate and undergraduate students?

It's all the students that are engaged in the IRP. We envision 10 students but we are unsure how many the budget would support. If you have any feedback about how many could be supported that would be helpful.

Can you give an example of a Grand Challenge?

We are working on those right now. I would rather not go into them right now. Any problem that we solve would have to be of significance to making nuclear energy more attractive. More importantly, it would need to focus on multi disciplines and focus on training and education the next workforce globally. It would need to be of interest to the U.S. and to the global community.

Does "US students" mean that students must be US citizens? Or students at US universities (potentially including foreign students)?

Students at U.S. universities.

When you will finalize the call, will you also identify what other countries you are interested in, or do we have to find out on our own?

We will give the details of that in the call. Current vision is that the countries have to be members of the OECD/NEA. We will define rules on who you can seek collaborations from. The U.S. institution would need to make those connections on their own.

Would it be possible to use funds for equipment, supplies, etc, or exclusively for faculty/student costs? What about post-doc researchers?

There are no restrictions on NEUP or IRP on equipment or supplies. There are no restrictions from this specific IRP scope that would prevent that. The freedom to purchase equipment is there but remember that the focus is training the next generation workforce

and the faculty participation. There will be no additional money for equipment and the project budget is at $3 million. Those are U.S. funds for use in the U.S.

Would this challenge problem surround a facility or multiple facilities, a national laboratory, or purely academic?

There is no focus that we have envisioned at this time. I would have to think about that a little more and write the final call to address that.

Would "Making nuclear energy more attractive" be evaluated in the eyes of the general public?

Once we give you examples of the types of grand challenge problems we will leave it up to the proposer to identify a problem that they think will make use of nuclear energy more attractive in the future. We haven't put the scope and evaluation criteria together on how we would judge that. That will be specified in the revised call.

Is training students to resolve the grand challenge the dominant focus of this IRP?

That is a key part of the objective but we have to have a significant problem you are solving. The concept is that through solving that grand challenge with faculty and others that a student would gain expertise for safe use of nuclear energy globally.

Would this IRP address remediation, fixation, of radioactive nuclides accidentally released?

I can't say at this point.

Will the international collaborators work on the same, or different tasks?

The vision is that there is one grand challenge problem and everyone is working toward solving that problem. The collaboration would have different tasks that lead to completion of that grand challenge. The task structure would have to be proposed in the IRP and agreed to by all participants.

What time horizon would be regarded as credible for solutions?

The idea is that the challenge would be such that it could be solved within three years with the resources that are available. Currently it is three years.

Which of nuclear power's grand challenges can be solved in three years?

We will address that in the call and give examples about what we think is doable in three years.

Is there any restriction as to what foreign government agencies can fund international collaborators on CINR IRP projects?

As stated during the webinar, all U.S. funds must be used to support faculty and students at U.S. educational institutions. It is envisioned that the international educational institution will receive financial support from their own country. At this time, we do not envision any restriction on the type of foreign government agency that will provide funding to the international institution.

Our current vision is that the international collaborating institutions would be from countries who are members of NEA. Please refer to the NEA website (https://www.oecd-nea.org/general/about/mcnea.html) for a list of their member countries. Complete requirements for international partners will be provided in the full IRP announcement.

Will a topic on ASME Code design development an interest for the IRP-NE-1 Grand Challenge for Nuclear Energy solicitation?

Please note that we are still in the process of finalizing the full IRP announcement. Therefore, it is not appropriate to offer any advice on the appropriateness of a subject area at this time. However, the applicants should keep in mind the limitations of the planned IRP award – the project duration should be three years or less.

IRP-EM-1, 2 and 3 Overview

Q. Are you looking explicitly or exclusively for humanoid arms or hands, or, would you be interested in modular and/or multiple-effect defectors? (IRP-EM-2)
A. We are not exclusive to robotic arms or hands. The reason that that was presented in this particular IRP is because that is something that is easily visualized. If you come up with an alternate or different design, we are open to that.

Q. What percentage of funds should go to hardware vs. software?
A. That is up to the individual proposer. The end product is a functional prototype, so to the extent you can take advantage of existing robotic devices in terms of hardware and to the extent that you are able to leverage off of certain software packages to control and drive, then that is something you folks are going to have to include in your proposal. We don't have any limit to what that percentage should/could be.

Q. In your opinion, how many PIs per proposal would you expect to see?
A. At a minimum, one (1). What we are looking for is certainly a university to submit a proposal; either as a PI, Co-PI, or Collaborating PIs, from another university; certainly that is the bottom line. We do ask that you collaborate with a National Laboratory, which does not necessarily need to be explicitly identified as a principal investigator, either as a co or collaborating, but certainly can be. There isn't any limit. What we're after is that you folk develop as capable a research team, a technology team, that can be assembled to provide the end product.

Q. The collaboration with law enforcement is required. Do we need to submit a letter of support, or is there some other way we need to explain that in the proposal? (IRP-EM-3)
A. Law Enforcement, including Firemen and Public Safety, will need to be substantiated with a letter of support from the respective organization. On IRP-3, in particular, the first responders can function in an advisory capacity. The idea is to get their insight, get their perspectives on if we are indeed able to develop a multi-purpose robotic device. One of those things that's important to them that you can build into the prototype.

Q. Do you have any advice for making connections with collaborators within the DOE-EM or National Laboratory structure, particularly for IRP-EM-2?
A. Contact Rodrigo Rimando (Rod) or Thomas Nance (Tom, Savannah River) directly. Any contacts shared will be posted publicly.

Q. In IRP-EM-3, will you consider humanoid robots?
A. Yes. We are looking for robotic platforms. We are not discounting humanoid robots to the extent that they can demonstrate functionality from normal operations as well as emergency response. I hesitate with humanoids just because that's a whole different class, a very sophisticated class of robots that, within the type of work we have, for us to actually deploy that, there's a lot of other factors that we have to consider. In terms of fundamental research, technology development, that is certainly not off the table, so I

would welcome those types of proposals that capitalize on humanoid robotics, particularly those that are within the research community now.

Q. For IRP-EM-1 workscope, do you support the design of new exo-skeletons using existing high-power actuators?
A. If you are leveraging existing technologies and components to include actuators, the answer is yes. On the one hand, while we would very much like to leverage what has been developed already, that does not preclude you from taking a look at new types of designs, so advanced actuators, advanced electronics, advanced semiconductors, advanced materials, for example, those could be features of the technologies from any of these IRPs.

Q. How many awards do you anticipate awarding in each area?
A. At least one award in each of the three IRPs; a large part of the number of awards is driven by the budget.

Q. Is radiation mapping and surveying part of the scope in IRP-EM-3?
A. Yes.

Q. Are we allowed to bid for two projects?
A. As a lead-PI, you are only allowed to bid on one project. However, you may collaborate on multiple IRP projects.

Q. What percentage of funds can go to National Laboratories?
A. No more than 20% of funds can go to non-university collaborators.

Q. Will National Laboratories be funded separately, or out of the funding limits outlined in the draft workscopes?
A. National Laboratories will be funded out of the funding limits outlined in the draft workscopes. As previously stated, that can be a maximum of 20% of the total budget.